AMENDMENT TO THE CLAIMS

Please amend claims 1, 7, 11-17 and 23 as follows:

1.(Presently Amended) An apparatus ~~disc storage system having a servo loop for positioning a head over a disc, the servo loop~~ comprising:

~~a voice coil motor actuator configured to move the head in response to a received servo control signal;~~

~~a sensor, located in the head, which is configured to sense servo information located on the disc and produce a servo signal therefrom, the servo signal is combined with a reference signal to produce a position error signal;~~

~~a servo controller configured to receive the position error signal and to responsively produce the servo control signal, the servo controller comprising:~~

~~a drive signal generator configured to receive the position error signal and to responsively produce a driving energy signal; and~~

~~a vibration damping circuit configured to receive the driving energy signal and to responsively produce the servo control signal; and~~

a vibration damping circuit coupled to receive a driving energy signal; and

a real-time adaptive loop shaping circuit configured to detect vibration energy in ~~the~~a position error signal in real-time, and to responsively adjust, in real-time, at least one parameter of a transfer function of the vibration damping circuit to reduce vibrations at different frequencies in the driving energy signal received by the vibration damping circuit.

2.(Original) The apparatus of claim 1 wherein the vibration

damping circuit includes a notch filter to damp vibrations at high frequency resonance modes, and wherein the real-time adaptive loop shaping circuit is configured to detect vibrations at high frequency resonance modes in the position error signal and to responsively adjust a depth of the notch filter.

3.(Original) The apparatus of claim 2 wherein the real-time adaptive loop shaping circuit adjusts the depth of the notch filter by modifying a gain of the notch filter.

4.(Original) The apparatus of claim 2 wherein the real-time adaptive loop shaping circuit includes a band-pass filter to detect vibrations at high frequency resonance modes in the position error signal.

5.(Original) The apparatus of claim 1 wherein the vibration damping circuit includes a non-repeatable runout compensator to cancel non-repeatable runout disturbances, and wherein the real-time adaptive loop shaping circuit is configured to detect non-repeatable runout disturbances in the position error signal and to responsively adjust at least one parameter of a transfer function of the non-repeatable runout compensator.

6.(Original) The apparatus of claim 5 wherein the real-time adaptive loop shaping circuit includes a band-pass filter to detect non-repeatable runout disturbances in the position error signal.

7.(Presently Amended) The apparatus of claim 1 wherein the vibration damping circuit includes a rotational vibration compensator to cancel rotational vibration disturbances, and wherein the real-time adaptive loop shaping circuit is configured to detect rotational vibration disturbances in the position error

signal and to responsively adjust at least one parameter of a transfer function of the ~~non-repeatable runout~~rotational vibration compensator.

8.(Original) The apparatus of claim 7 wherein the real-time adaptive loop shaping circuit includes a low-pass filter to detect rotational vibration disturbances in the position error signal.

9.(Original) The apparatus of claim 1 wherein the vibration damping circuit includes a plurality of disturbance adjustment compensators to cancel vibration disturbances at different frequency ranges, and wherein the real-time adaptive loop shaping circuit is configured to detect vibration disturbances at the different frequency ranges in the position error signal and to responsively adjust at least one parameter of a transfer function of at least one of the plurality of disturbance compensators.

10.(Original) The apparatus of claim 1 wherein the real-time adaptive loop shaping circuit includes a learning component that adjusts a speed of adaptation of the servo loop.

11.(Presently Amended) A method of maintaining stability in a servo loop ~~used for positioning a head over a disc in a disc drive, the servo loop~~ having ~~a voice coil motor actuator and~~ a servo controller ~~that controls the voice coil motor actuator~~, the method comprising:

~~(a) generating a servo signal based on the position of the head over the disc;~~

~~(b) generating an actuator control signal for driving the voice coil motor actuator based on a position error signal, wherein the position error signal is determined by combining the servo signal with a reference signal;~~

~~(c)~~ (a) detecting vibration energy in ~~the~~a position error

signal in real-time; and

~~(d)~~(b) adjusting, in real-time, at least one parameter of a transfer function of the servo controller to attenuate the vibration energy detected in step ~~(c)~~(a) at different frequencies.

12.(Presently Amended) The method of claim 11 wherein the detecting vibration energy step ~~(c)~~(a) includes detecting vibrations at high frequency resonance modes, and wherein the adjusting step ~~(c)~~(b) includes adjusting a depth of a notch filter of the servo controller to reduce vibrations at high frequency resonance modes.

13.(Presently Amended) The method of claim 11 wherein the detecting vibration energy step ~~(c)~~(a) includes detecting non-repeatable runout disturbances, and wherein the adjusting step ~~(c)~~(b) includes adjusting at least one parameter of a transfer function of a non-repeatable runout compensator of the servo controller to reduce non-repeatable runout disturbances.

14.(Presently Amended) The method of claim 11 wherein the detecting vibration energy step ~~(c)~~(a) includes detecting rotational vibration disturbances, and wherein the adjusting step ~~(c)~~(b) includes adjusting at least one parameter of a transfer function of a rotational vibration compensator of the servo controller to reduce rotational vibration disturbances.

15.(Presently Amended) The method of claim 11 wherein the detecting vibration energy step ~~(c)~~(a) and the adjusting ~~at least one parameter~~ step ~~(d)~~(b) is carried out by a real-time adaptive loop shaping circuit.

16.(Presently Amended) A ~~disc drive for storing information on a disc, the disc drive~~servo loop comprising:

a ~~servo loop for positioning a head over the disc, the servo loop including a servo controller and a voice coil motor actuator, the voice coil motor actuator is configured to move the head in response to a servo control signal generated by the~~ servo controller; and

a real-time adaptive loop shaping means for attenuating disturbances in the servo loop.

17. (Presently Amended) The apparatus of claim 16 wherein~~:~~

~~the servo loop further comprises:~~

~~a sensor, located in the head, which is configured to sense servo information located on the disc and produce a servo signal therefrom, the servo signal is combined with a reference signal to produce a position error signal; and~~

the real-time adaptive loop shaping means comprises a real-time adaptive loop shaping circuit adapted to:

detect vibration energy in ~~the~~a position error signal in real-time, and to responsively adjust, in real-time, at least one parameter of a transfer function of a vibration damping circuit of the servo controller to reduce vibrations at different frequencies in the servo loop.

18.(Original) The apparatus of claim 17 wherein the vibration damping circuit includes a notch filter to damp vibrations at high frequency resonance modes, and wherein the real-time adaptive loop shaping circuit is configured to detect vibrations at high frequency resonance modes in the position error signal and to responsively adjust a depth of the notch filter.

19.(Original) The apparatus of claim 18 wherein the real-time adaptive loop shaping circuit adjusts the depth of the notch filter by modifying a gain of the notch filter.

20.(Original) The apparatus of claim 18 wherein the real-time adaptive loop shaping circuit includes a band-pass filter to detect vibrations at high frequency resonance modes in the position error signal.

21.(Original) The apparatus of claim 17 wherein the vibration damping circuit includes a non-repeatable runout compensator to cancel non-repeatable runout disturbances, and wherein the real-time adaptive loop shaping circuit is configured to detect non-repeatable runout disturbances in the position error signal and to responsively adjust at least one parameter of a transfer function of the non-repeatable runout compensator.

22.(Original) The apparatus of claim 21 wherein the real-time adaptive loop shaping circuit includes a band-pass filter to detect non-repeatable runout disturbances in the position error signal.

23.(Presently Amended) The apparatus of claim 17 wherein the vibration damping circuit includes a rotational vibration compensator to cancel rotational vibration disturbances, and wherein the real-time adaptive loop shaping circuit is configured to detect rotational vibration disturbances in the position error signal and to responsively adjust at least one parameter of a transfer function of the ~~non-repeatable runout~~ rotational vibration compensator.

24.(Original) The apparatus of claim 23 wherein the real-time adaptive loop shaping circuit includes a low-pass filter to detect

rotational vibration disturbances in the position error signal.

25.(Original) The apparatus of claim 17 wherein the vibration damping circuit includes a plurality of disturbance adjustment compensators to cancel vibration disturbances at different frequency ranges, and wherein the real-time adaptive loop shaping circuit is configured to detect vibration disturbances at the different frequency ranges in the position error signal and to responsively adjust at least one parameter of a transfer function of at least one of the plurality of disturbance compensators.

26.(Original) The apparatus of claim 17 wherein the real-time adaptive loop shaping circuit includes a learning component that adjusts a speed of adaptation of the servo loop.